US005711695A

United States Patent [19]

Moran et al.

[11] **Patent Number: 5,711,695**

[45] **Date of Patent: Jan. 27, 1998**

[54] **GAS-PROPELLED TOY WITH EXHAUST NOZZLE FOR GAS CARTRIDGE**

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[21] Appl. No.: **432,571**

[22] Filed: **May 1, 1995**

[51] **Int. Cl.**[6] **A63H 29/16**

[52] **U.S. Cl.** **446/211**; 446/457; 222/5; 60/200.1

[58] **Field of Search** 446/199, 211, 446/212, 56, 163, 204, 457, 206; 239/601; 222/5; 180/7.3; 60/200.1; 124/57, 58, 60

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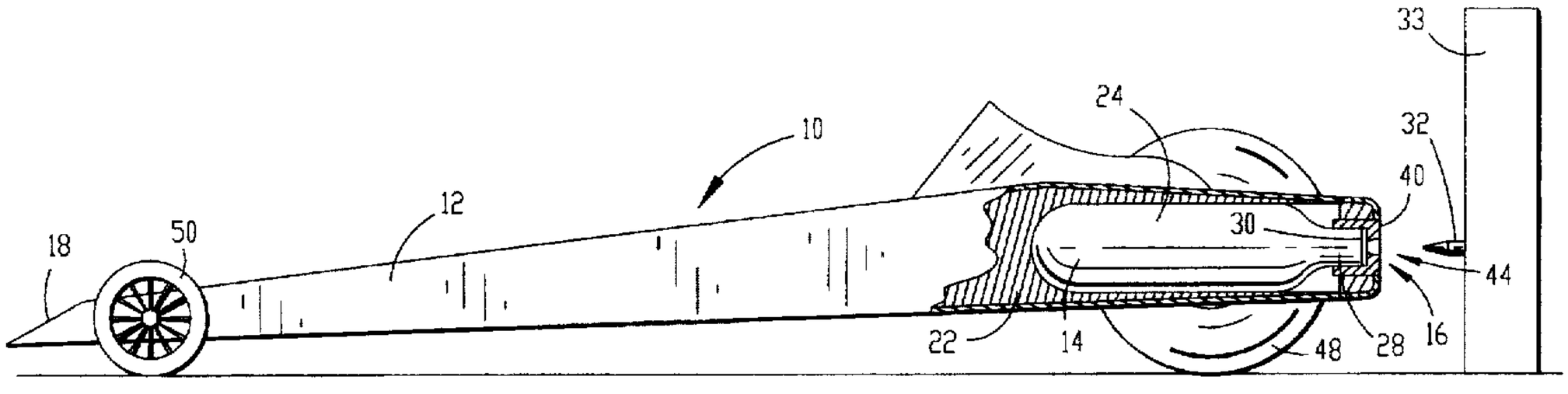
[57] **ABSTRACT**

A gas-propelled toy comprises a vehicle body having opposed front and rear ends, a cartridge of pressurized gas carried by the vehicle body, the cartridge presents an elongated, tubular neck outlet and a frangible plug terminal adjacent to the end of the neck outlet for preventing release of gas from the cartridge, the cartridge is oriented adjacent to the rear end of the vehicle body with the neck outlet facing rearwardly, and an annular, thrust-enhancing exhaust nozzle having a sidewall disposed about the neck outlet, and an apertured end plate adjacent to and in substantial registry with the plug terminal. The aperture presents an arcuate wall, and is configured for permitting passage therethrough of a firing pin in order to pierce the plug terminal and enhancing the thrust due to the subsequent exhaust of said gas within the cartridge, in order to forwardly propel vehicle body.

9 Claims, 1 Drawing Sheet



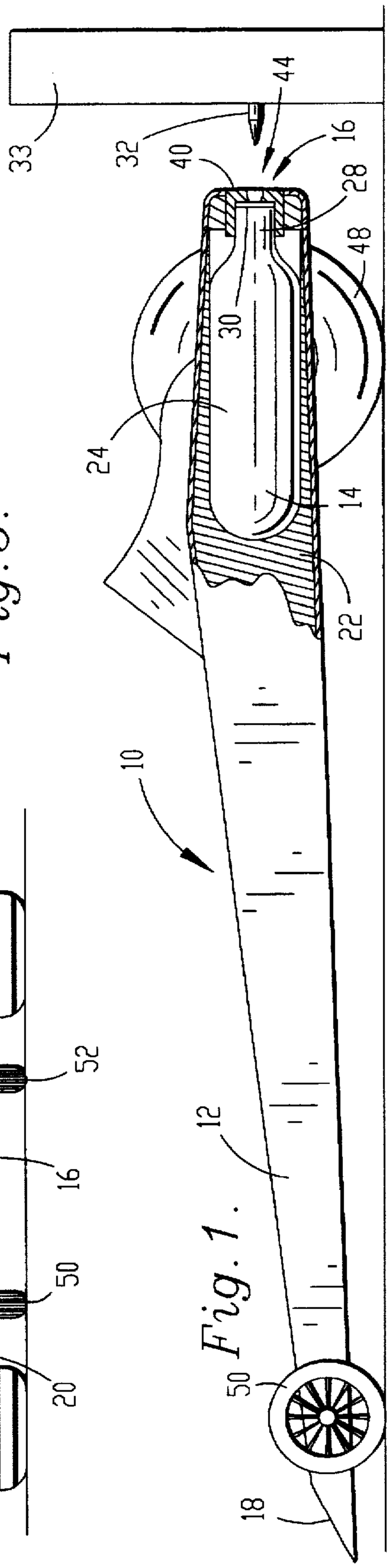


Fig. 1.

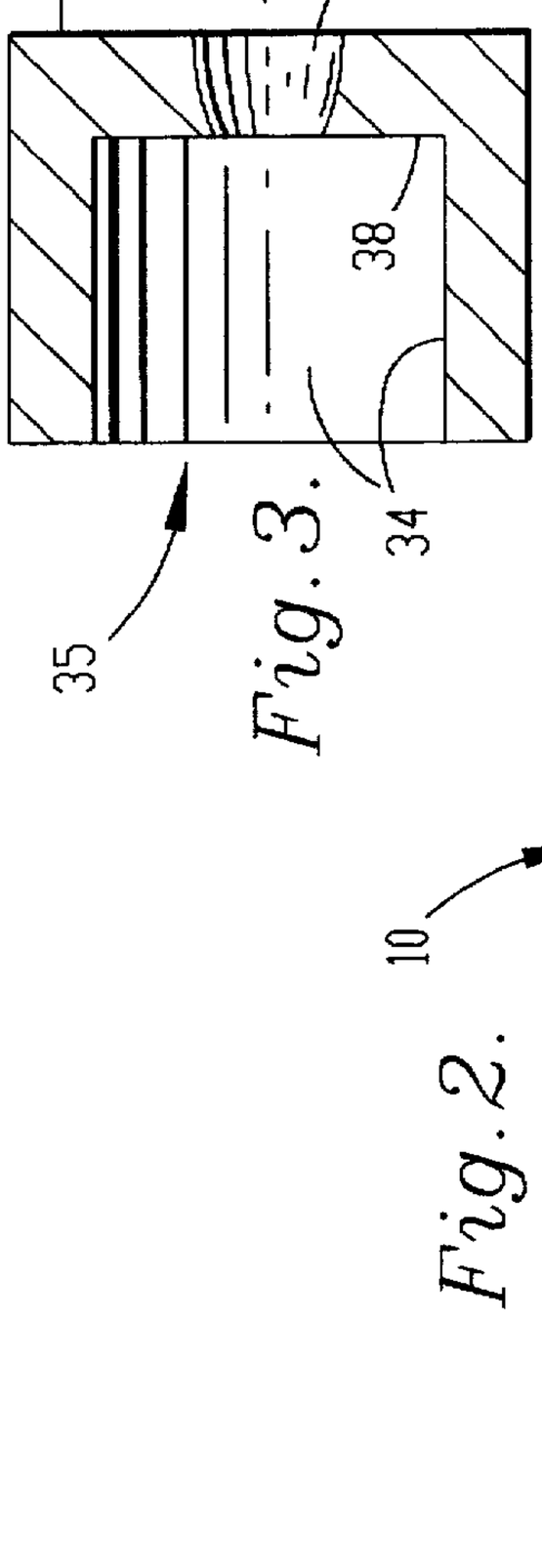


Fig. 3.

Fig. 6.

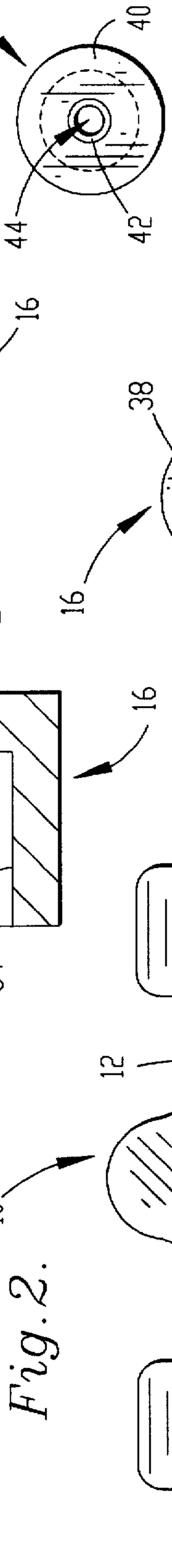


Fig. 4.

Fig. 5.

Fig. 2.

GAS-PROPELLED TOY WITH EXHAUST NOZZLE FOR GAS CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to gas-propelled toys propelled by the propulsive force, or thrust, produced by the release of pressurized gases. More particularly, the invention concerns a removable exhaust nozzle which may be fitted to a pressurized gas cartridge for improved thrust characteristics.

2. Description of the Prior Art

Various toys are propelled by the release of gases from a pressurized gas container, such as a CO_2 cartridge. Examples of gas-propelled toys include airplanes, rockets, boats and dragsters.

The prior art discloses the use of a disposable pressurized gas cartridge which includes an outlet having a frangible plug terminal to prevent the gases from exiting the cartridge. The cartridge is attached to the device so that the outlet is pointed in the opposite direction of intended travel. Once the terminal is pierced by a firing pin, the cartridge releases exhaust gases through the outlet resulting in forward thrust until the cartridge is spent. The cartridge is then discarded.

Gas propelled devices generally include a cavity provided in the device which allows insertion of the cartridge into the device. The cavity also provides access to the plug terminal so that it may be readily pierced initiating use of the device.

The cartridge, however, may not be firmly seated in such a cavity. As a result, the exhaust gases often are not released in a direction which is axially aligned with the longitudinal axis of the gas-propelled toy, thereby reducing the forward thrust. Additionally, such a cavity allows the cartridge to be improperly pierced. For example, with no means of guiding the firing pin, the plug terminal may be pierced along is periphery or at an angle. Improper piercing causes misdirection of the exhaust gases, which reduces the forward thrust of the exhaust gases. The plug terminal may also be improperly pierced if the piercing means creates a relatively large hole which would result in the rapid and inefficient exhaustion of the gases.

The outlets provided in pressurized gas cartridges do not efficiently direct the flow of the exhaust gases. For example, when the plug terminal is pierced, portions of the terminal are folded into the neck outlet, causing turbulence in the flow of the exhaust gases. This turbulence results in gases which are not efficiently aligned. Therefore, a significant amount of the energy produced by the exhaust gases is lost even when the plug terminal is properly pierced.

The prior art also discloses a pressurized gas container that is included as an integral component of the gas propelled device. For instance, U.S. Pat. No. 3,010,444 discloses an aerial toy device which includes a refillable pressurized gas container having an electrically actuated means for initiating the release of gas. While such containers are refillable, and, therefore, reusable, they are also relatively difficult and expensive to construct. Therefore, the prior art presents a significant and heretofore unsolved need to provide an economically efficient means of directing the flow of gases being exhausted by a pressurized gas cartridge for increasing the thrust produced by the gases.

SUMMARY OF THE INVENTION

The present invention solves the prior art problems discussed above and provides a distinct advance in the state of the art. More particularly, the gas-propelled toy hereof includes an economical and efficient way to direct gas exhaust for producing maximum thrust.

The preferred gas-propelled toy broadly includes a wheeled vehicle body, a cartridge of pressurized gas carried by the body, and an annular, thrust-enhancing exhaust nozzle. The vehicle body includes opposed front and rear ends, and a cartridge carrying cavity provided in the rear end.

The cartridge presents an elongated, tubular neck outlet and a frangible plug terminal adjacent to the end of the neck outlet. The plug terminal prevents the release of the gases from the cartridge. Once the plug terminal is pierced, the pressurized gas is released through the neck outlet creating thrust until the cartridge is spent.

The cartridge is inserted into the cavity of the vehicle body so that the neck outlet faces rearwardly relative to the vehicle body. Therefore, the thrust created by the exiting gases propels the vehicle body forward.

The annular, thrust enhancing exhaust nozzle includes a sidewall and an end plate having an inner face and an outer face. The end plate includes an arcuate wall which defines an aperture. The aperture diverges from the inner face to the outer face. Once the cartridge is inserted into the cavity, the nozzle may be seated on the neck outlet of the cartridge so that the nozzle sidewall is disposed about the neck outlet, and the aperture is adjacent to and in substantial registry with the plug terminal.

The aperture is configured for permitting the passage of a firing pin in order to pierce the plug terminal, aligning the firing pin and enhancing the subsequent exhaust of the gas from the cartridge through the outlet, in order to forwardly propel the vehicle body. The nozzle also forcibly aligns the pressurized gas cartridge into alignment with the longitudinal axis of the gas-propelled toy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of the preferred gas-propelled toy shown in partial section with the rear of the toy adjacent a wall presenting a firing pin;

FIG. **2** is a rear view of the toy of FIG. **1**;

FIG. **3** is a side sectional view of the preferred gas exhaust nozzle of the toy of FIG. **1**;

FIG. **4** is rear view of the exhaust nozzle of FIG. **3**;

FIG. **5** is front end view of the exhaust nozzle of FIG. **3**; and

FIG. **6** is a side sectional view of the preferred gas exhaust nozzle of the toy of FIG. **3**, depicting a firing pin in dashed lines extending through the aperture.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1**, gas-propelled toy **10** broadly includes vehicle body **12**, cartridge **14** of pressurized gas carried by the body, and annular, thrust-enhancing exhaust nozzle **16**. Vehicle body **12** includes opposed front and rear ends **18** and **20**. Cartridge carrying cavity **22** is provided in rear end **20** of vehicle body **12**.

Cartridge **14** includes hollow main portion **24** having generally cylindrical outer surface **26**, elongated tubular neck outlet **28** and frangible plug terminal **30** adjacent to the end of neck outlet **28**. Pressurized gas, such as CO_2 gas, is stored in cartridge **14**. Cartridge **14** may be constructed of metallic material, synthetic resin material, or other material that is suitable for containing the pressurized gas without explosion.

Plug terminal **30** prevents the release of the gas from cartridge **14**. Plug terminal **30** may be pierced by firing pin **32**. FIG. **1** discloses firing pin **32** mounted to stationary blast wall **33**, however, firing pin **32** may be mounted to a moveable support, such as a board, or, alternatively, firing pin **32** may be unattached. Once plug terminal **30** is pierced, the pressurized gas exits cartridge **14** through neck outlet **28** resulting in the creation of thrust.

Cartridge **14** is carried by vehicle body **12** so that neck outlet **28** faces rearwardly relative to body **12**. Piercing plug terminal **30** results in release of the exhaust gases in a direction which is generally axially aligned with the longitudinal axis of toy **10**. Therefore, the thrust created by the release of the exhaust gases propels toy **10** forward.

Referring now to FIGS. **3–5**, annular, thrust enhancing exhaust nozzle **16** includes sidewall **34** and apertured end plate **36** with inner face **38** and outer face **40**. Sidewall **34** defines neck outlet receiving portion **35** having a generally uniform diameter. The diameter of sidewall **34** is substantially the same as the exterior diameter of neck outlet **28**. Therefore, nozzle **16** may be frictionally fitted onto cartridge **14** by placing receiving portion **35** over neck outlet **28**. Nozzle **16** may be constructed of metallic material, synthetic resin material, or other suitable material. Additionally, nozzle **16** may be machined, or molded.

End plate **36** includes arcuate wall **42**. Arcuate wall **42** defines aperture **44** which diverges from inner face **38** to outer face **40**. The diameter of aperture **44** at a point adjacent to inner face **38** is substantially the same as the diameter of firing pin **32**. It will be appreciated that this prevents the pressurized gas in cartridge **14** from escaping until firing pin **32** has been removed from neck outlet **28**, thereby maximizing the available thrust.

Preferably, the diameter of aperture **44** is between about 0.05"–0.25". For example, the diameter of aperture **44** at a point adjacent to inner face **38** may be approximately 0.10", and the diameter of aperture **44** at a point adjacent to outer face **40** may be approximately 0.146". When aperture **44** has such dimensions, arcuate wall **42** forms an arc of a circle having a radius of about 0.248". This radius is depicted in FIG. **3**. The dimensions of aperture **44** as previously stated may be changed so that nozzle **16** may be used with cartridges of differing sizes. Additionally, arcuate wall **42** may form an arc of various geometric shapes, such as an ellipse, a parabola, or a hyperbola.

Arcuate wall **42** of aperture **44** is configured so that the tangential line of arcuate wall **42** at a point adjacent to outer face **40** is axially aligned with the longitudinal axis of nozzle **16**, and thus toy **10** when nozzle **16** is attached to toy **10**. Arcuate wall **42**, therefore, enhances the thrust resulting from the exhaust of the gas from cartridge **14** through outlet **28** by redirecting non-aligned exhaust gases into axial alignment with the longitudinal axis of toy **10**.

FIG. **1** depicts cartridge **14** inserted into cavity **22** of vehicle body **12** with nozzle **16** seated on neck outlet **28** of cartridge **14** so that sidewall **34** is disposed about neck outlet **28**. Aperture **44** of end plate **36** is adjacent to and in substantial registry with plug terminal **30**. It will be appreciated that by seating nozzle **16** on neck outlet **28**, cartridge **14** is necessarily aligned with the longitudinal axis of toy **10**.

In operation, toy **10** is prepared for use by inserting cartridge **14** into cavity **22** of vehicle body **12** and seating nozzle **16** on cartridge **14**. Receiving portion **35** of nozzle **16** frictionally fits nozzle **16** onto cartridge **14**. When frangible plug terminal **30** is pierced by firing pin **32**, the pressurized gas begins to exit cartridge **14** resulting in forward thrust, and thus forward motion of vehicle body **12**.

It will be appreciated that nozzle **16** protects cartridge **14** from improper piercing while increasing the thrust produced by the exhaust gases. For example, by seating nozzle **16** on neck outlet **28** of cartridge **14**, the exposed area of plug terminal **30** is reduced. Additionally, by providing exhaust nozzle **16** including aperture **44** having approximately the same size as firing pin **32**, firing pin **32** will be forcibly properly positioned when piercing plug terminal **30**.

Improper piercing may occur when plug terminal **30** is pierced along its periphery, or if firing pin **32** is too large, resulting in a large hole through plug terminal **30**, and inefficient exhaustion of the pressurized gases. Proper placement of firing pin **32** as well as proper sizing of the hole pierced by firing pin **32** in plug terminal **30** maximizes the efficiency of neck outlet **28**, and thus cartridge **14**.

Once plug terminal **30** has been pierced, arcuate wall **42** of nozzle **16** directs the exhaust gases into axial alignment with the longitudinal axis of toy **10**. Such redirection of the exhaust gases maximizes the forward thrust. After cartridge **14** is spent, nozzle **16** may be removed so that cartridge **14** may be disposed. Nozzle **16** is saved for reuse.

Toy **10** may be any of a plurality of types of gas-propelled toys. For example, toy **10** of the illustrated preferred embodiment is a surface engaging toy having surface engaging wheels **46**, **48**, **50** and **52** provided adjacent to vehicle body **12**. Surface engaging wheels **46**, **48**, **50** and **52** allow toy **10** to be propelled along a horizontal plane relative to the ground, or along a plane which is inclined relative to the ground.

Toy **10** may also be a water craft toy by providing a floatable vehicle body. Such a device may be used on a body of water, such as a pool, pond, river, lake, or ocean.

Alternatively, toy **10** may be an aerial toy, such as an airplane or rocket. For example, providing lift producing airfoils, such as wings, would allow the device to be propelled in flight by the exhaust gases. Use of exhaust nozzle **16** increases the flight speed of the airplane-type aerial toy, and thus the distance flown. Once cartridge **14** is spent, the airplane toy would glide back to the ground for recovery.

A rocket-type aerial toy would provide a cylindrical vehicle body having fins along rear end **20** for stabilized flight and a deployable parachute. The rocket toy could then be launched into the air by piercing plug terminal **30**. Once cartridge **14** is spent, the parachute would deploy, and the rocket toy would then float back to the ground for recovery. Exhaust nozzle **16** would increase the in-flight speed of the rocket toy, and, thus, the altitude reached at the pinnacle of its flight.

Although toy **10** and nozzle **16** have been described with reference to the illustrated preferred embodiment, it is noted that variations and changes may be made and equivalents employed herein without departing from the scope of the invention as recited in the claims. For example, sidewall **34** of nozzle **16** of the illustrated preferred embodiment defines neck outlet receiving portion **35** having a substantially uniform diameter which may be frictionally fitted to neck outlet **28**. Those skilled in the art will appreciate that sidewall **34** may alternatively have any of a plurality of shapes and sizes.

Sidewall **34** may be sloped or stepped, so that the diameter of receiving portion **35** decreases towards inner face **38**. When sidewall **34** is slopped, receiving portion **35** is uniformly tapered, thereby allowing nozzle **16** to be frictionally fitted to various cartridges having neck outlets with varying shapes and sizes. Providing a stepped sidewall would also

allow nozzle **16** to be fitted to cartridges having neck outlets with various shapes and sizes. Although the stepped sidewall could not be fitted to neck outlets having as many shapes and sizes as the sloped sidewall, the area of contact would be increased between neck outlet **28** and the stepped sidewall compared with a tapered receiving portion of the sloped sidewall, thereby yielding a relatively preferable frictional fit.

Various internal features may be provided to improve the fit of the nozzle on neck outlet **28**. For instance, sidewall **34** may include a transverse groove for receiving an o-ring. By providing an o-ring in sidewall **34**, the frictional fit between nozzle **16** and neck outlet **28** would be improved. Providing a ribbed sidewall would also improve the frictional fit of nozzle **16** onto cartridge **14**. The methods involved in manufacturing such nozzles, and especially the addition of an o-ring, would undesirably increase the cost of manufacturing the nozzle compared with nozzle **16** of the preferred embodiment.

Another internal feature which may be utilized to improve the fit of nozzle **16** on neck outlet **28** includes internal threads provided on sidewall **34**. An internally threaded nozzle would thus receive an externally threaded neck outlet. Again, such a feature would have the undesirable effect of increasing the costs of manufacturing nozzle **16**.

We claim:

1. A gas-propelled toy, comprising:

a vehicle body having opposed front and rear ends;

a cartridge of pressurized gas carried by said body, said cartridge presenting an elongated, tubular neck outlet and a frangible plug terminal adjacent the end of said neck outlet for preventing release of gas from said cartridge;

said cartridge being oriented adjacent the rear end of said toy body with said neck outlet facing rearwardly; and

an annular, thrust-enhancing exhaust nozzle having a sidewall disposed about said neck outlet, and an end plate, said end plate having an arcuate wall defining an aperture,

said aperture adjacent to and in substantial registry with said plug terminal,

said aperture configured for permitting passage therethrough of a firing pin in order to pierce said plug terminal, and for subsequent exhaust therethrough of said gas within the cartridge upon release of said toy, in order to forwardly propel said toy, and

said end plate being in contact with said plug terminal.

2. The toy of claim **1**, said nozzle sidewall being in contact with said neck outlet.

3. The toy of claim **1**, said end plate having an inner face adjacent said plug terminal and an opposed outer face, said aperture diverging from said inner to said outer face.

4. The toy of claim **3**, said nozzle having a longitudinal axis, said arcuate wall defining an arc of a circle, the line tangent to said arcuate wall at said outer face being axially aligned with said longitudinal axis of said nozzle.

5. The toy of claim **3**, the diameter of said aperture at said inner face being from about 0.05"–0.25".

6. The toy of claim **3**, the diameter of said aperture at said inner face being about 0.10".

7. The toy of claim **6**, said arcuate wall defining an arc of a circle having a radius of about 0.248".

8. The toy of claim **1**, said toy being a surface engaging vehicle, said body including surface-engaging wheels.

9. The toy of claim **1**, the thickness of said end plate being from about 0.05"–0.25".

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